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Glyptothorax pulcher (Siluriformes, Sisoridae), a new species from the upper Pearl River of Yunnan and Guangxi, southwest China

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Abstract

A new species of the genus *Glyptothorax*, *Glyptothorax pulcher* **sp. nov.** is described from the Tuoniang River, the Pearl River Basin, in south-eastern Yunnan Province and western Guangxi Zhuang Autonomous Region, China. This new species most closely resembles *G. quadriocellatus* in overall morphology, including similar outline appearance, skin tubercles and colour pattern. It can be distinguished from its congeners that are found in east of the Red River in China by the following combination of characteristics: distinctive colour pattern, skin with sparse soft tubercules, dorsal surface of head smooth, thoracic adhesive apparatus (TAA) broad (length of 1–1.2 times its width, width of TAA 12.0–14.3% SL), adipose-fin base short (11.7–15.4% SL), caudal peduncle deep and short (13.7–17.5% SL in length, 10.3–12.3% SL in depth). Its validity is further confirmed by molecular phylogenetic analysis, based on mitochondrial *CO*I and Cyt *b* gene sequences, indicating it forms a sister group with *G. pallozonum*. The estimated K2P genetic distances between the new species and *G. pallozonum* range from 5.7% to 6.0%. In addition, phylogenetic evidence also suggests that *G. zhujiangensis* not be a valid species, but rather a junior synonym of *G. pallozonum* in this study.

Key Words

*CO*I, Cyt *b*, morphological differentiation, phylogeny, Tuoniang River

Introduction

Glyptothorax Blyth, 1860, a group of small-sized catfish, is widespread, from the Euphrates and Tigris River Basins in Turkey in the west, to the Yangtze River in China in the east (Jiang et al. 2011) and southwards to Borneo and Java (Ng and Kottelat 2016), representing the highest diversity in the family Sisoridae. The most prominent characteristic of *Glyptothorax* is the presence of a thoracic adhesive apparatus (TAA, consisting of longitudinal or oblique cutaneous folds arranged in an approximately elliptical area on the thoracic region), which enables adaptation to swift-flowing hill-streams and rivers with a sandy or rocky substrate (Ng and Kottelat 2023). As of 2025, a total of 27 species of *Glyptothorax* have been documented in China (Ng and Kottelat 2023; Chen et al. 2024).

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Most of them were distributed from south-western China, including the Brahmaputra, Irrawaddy, Nujiang-Salween, Lancangjiang-Mekong River and Red River, while only four species were observed across a vast expansion to the east of the Red River in China, including the Pearl River, Yangtze River, Hainan Island and the south-eastern coastal area. These four species *Glyptothorax sinensis* (Regan, 1908), *G. hainanensis* (Nichols & Pope, 1927), *G. pallozonum* (Lin, 1934) and *G. zhujiangensis* Lin, 2003 are currently distributed in this vast area, with no new species discovered in this area for more than two decades.

Glyptothorax pulcher sp. nov., a new species distributed in the Tuoniang River (a tributary of the Pearl River), characterised by a uniform dark body colouration and bright-yellow spots and stripes, is described in this study. Molecular phylogenetic analysis was employed to confirm its taxonomic distinctiveness. This study further provides the taxonomic revision of the remaining *Glyptothorax* species west of the Red River and re-assessed the taxonomic status of *G. zhujiangensis*.

Materials and methods

Specimens were collected from Yunnan and Guangxi, China, during 2023 and 2024. All the specimens were initially preserved in 10% formalin and subsequently transferred to 75% ethanol for long-term storage. The right pelvic fin of some specimens were clipped and preserved in analytically pure alcohol for molecular analysis. The holotype specimen and 17 paratype specimens were deposited in the Kunming Zoological Museum, Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences, while the remaining 10 paratype specimens were preserved in Hong-Fu Yang's Specimen Room in Fisheries Administration of Qiubei, Yunnan Province.

Measurements and terminologies follow those of Ng and Kottelat (2016). Fin ray and vertebral counts were assessed via X-ray imaging, with the latter counted following the method of Roberts (1993). Measurements were taken using a micrometer caliper and recorded to the nearest 0.1 mm. Counts and measurements were taken on the left side of each specimen whenever feasible. In tables and text, the subunits of the head are expressed as proportions of head length (HL) and measurements of the head and body are expressed as proportions of standard length (SL).

Eleven sequences of the cytochrome c oxidase subunit I (*COI*) gene and nine mitochondrial cytochrome b gene (Cyt *b*) sequences from seven *Glyptothorax* species were obtained and uploaded to NCBI GenBank during this study. An additional eight *COI* and Cyt *b* sequences for relevant *Glyptothorax* species were sourced from Jiang et al. (2011), showing in Table 1. In total, nineteen *COI* and seventeen Cyt *b* sequences representing seven *Glyptothorax* species were used in the molecular phylogenetic analysis. *Bagarius protos* Zeng et Chen was used as the outgroup to represent *Bagarius*, which has been revealed as the sister group of *Glyptothorax* (Ng and Jiang 2015). *Pseudecheneis brachyura* Zhou, Li et Yang was also included as another outgroup.

MEGA 11 (Tamura et al. 2021) was used to align the sequences and calculate the genetic distances amongst species. Both the Maximum Likelihood (ML) and

Table 1. Collection localities and accession numbers of molecular samples.

Species No.	Taxon	Location	Accession number	
			COI	Cyt *b*
	Ingroup			
(1)	*Glyptothorax hainanensis* 1	China: Hainan, Baisha	HQ593584	HQ593597
	Glyptothorax hainanensis 2	China: Hainan, Qionghai	PX556454	PX548353
(2)	*Glyptothorax honghensis* 1	China: Yunnan, Xinping	HQ593583	HQ593596
	Glyptothorax honghensis 2	China: Yunnan, Hekou	PX556455	PX548354
(3)	*Glyptothorax interspinalum* 1	China: Yunnan, Lvchun	HQ593563	HQ593589
	Glyptothorax interspinalum 2	China: Yunnan, Hekou	PX556456	–
(4)	*Glyptothorax macromaculatus*	China: Yunnan, Baoshan	HQ593568	HQ593592
(5)	*Glyptothorax pallozonum* 1	China: Guangdong, Haifeng	HQ593586	HQ593599
	Glyptothorax pallozonum 2	China: Guangdong, Foshan	PX556457	PX548355
(6)	*Glyptothorax pulcher* sp. nov. 1	China: Yunnan, Bamei	PX556458	PX548356
	Glyptothorax pulcher sp. nov. 2	China: Yunnan, Guangnan	PX556459	PX548357
	Glyptothorax pulcher sp. nov. 3	China: Yunnan, Guangnan	PX556460	PX548358
	Glyptothorax pulcher sp. nov. 4	China: Yunnan, Guangnan	PX556461	PX548359
(7)	*Glyptothorax quadriocellatus* 1	China: Yunnan, Lvchun	HQ593562	HQ593588
	Glyptothorax quadriocellatus 2	China: Yunnan, Lvchun	PX556462	–
	Glyptothorax quadriocellatus 3	China: Yunnan, Jinpin	PX556463	PX548360
(8)	*Glyptothorax sinensis* 1	China: Guangxi, Longlin	HQ593585	HQ593598
	Glyptothorax sinensis 2	China: Sichuan, Panzhihua	HQ593580	HQ593594
(9)	*Glyptothorax* cf. *zhujiangensis*	China: Guangdong, Zhongshan	PX556464	–
	Outgroup			
(10)	*Bagarius protos*	China: Yunnan, Longling	PV669790	PX548361
(11)	*Pseudecheneis brachyura*	China: Yunnan, Tengchong	PX556465	PX548362

Bayesian Inference (BI) methods were used to reconstruct phylogenetic relationships, based on the concatenated dataset of two genes. ML phylogenies were inferred by means of IQ-TREE (Nguyen et al. 2015) with ultrafast bootstrap support (Minh et al. 2020), based on 1,000 iterations. BI analyses were carried out using MrBayes v.3.2.6 (Ronquist et al. 2012) within PhyloSuite v.1.2.2 (Zhang et al. 2020). The best-fitting nucleotide substitution models were selected using ModelFinder (Kalyaanamoorthy et al. 2017), based on the the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), respectively: TIM3+F+I+G4 for ML and GTR+F+I+G4 for BI analyses. The BI analysis consisted of two independent runs of Markov Chain Monte Carlo (MCMC), each with one cold and three heated chains, for 10 million generations. Trees were sampled every 1,000 generations and the first 25% of trees were discarded as burn-in. Convergence was confirmed when the average standard deviation of split frequencies dropped below 0.01. The resulting phylogenetic tree was visualised and edited using FigTree v.1.4.4.

Results

Glyptothorax pulcher Zeng, Lin, Jiang & Chen, sp. nov.

https://zoobank.org/2028ED64-B345-422A-AB9C-C3540186F7F4

Fig. 1

Type material. ***Holotype.*** • KIZ2025000024, 83.5 mm SL, Tuoniang River [驮娘江], Bamei Town [坝美镇], Guangnan County [广南县], Wenshan City [文山市], Yunnan Province [云南省], China, leg. Xin-Rui Pu, November 2024.

Paratypes. • KIZ2025000023, 1 ex, 85.5 mm SL, other information same as holotype; • KIZ2025000022, 1 ex, 96.6 mm SL, locality information same as holotype, leg. Xin-Rui Pu, December 2023; • KIZ2025000007–21, YHF20250001–10, 25 ex, 53.7–106.4 mm SL, Xiyang River [西洋江], Banbang Township [板蚌乡], Guangnan County, Wenshan City, Yunnan Province, China, leg. Hong-Fu Yang, May 2024; • KIZ20250000025–26, 2 ex, 47.1–60.2 mm SL, Leli River [乐里河], Tianlin County [田林县], Baise City [百色市], Guangxi Zhuang Autonomous Region [广西壮族自治区], China, leg. Yu-Sen Li & Feng Lin, December 2024.

Diagnosis. *Glyptothorax pulcher* can be distinguished from its congeners distributed in the adjacent water systems of the Pearl River by the following combination of characteristics: distinctive colour pattern, skin with sparse tubercules, soft and similar in texture to skin, dorsal surface of head smooth, TAA broad (length of 1–1.2 times its width, width of TAA12.0–14.3% SL), adipose-fin base short (11.7–15.4% SL), caudal peduncle deep and short (13.7–17.5% SL in length, 10.3–12.3% SL in depth).

Description. Morphometric data are shown in Table 2. Head depressed, body subcylindrical. Dorsal profile rising evenly from tip of snout to origin of dorsal fin and then sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile flat to anal-fin base, then sloping gently dorsally from anal-fin base to end of caudal peduncle. Anus and urogenital openings located 1/2 distance between end of pelvic-fin base and origin of anal-fin ray. Skin with soft tubercules. Lateral line complete, situated in mid-line of body. Vertebrae 17+18 = 35* (4), 17+19 = 36 (5), 18+18 = 36 (4) or 18+17 = 35 (3).

Head depressed and broad, longer than broad. Snout blunt. Anterior and posterior nares separated only by base of nasal barbel. Gill openings broad, extending from directly beneath post-temporal to isthmus. Bony elements of dorsal surface of head covered with thick and smooth skin. Eyes small and ovoid, horizontal axis longest, located in dorsal half of head.

Table 2. Morphometric data for *Glyptothorax pulcher* sp. nov.

	***Glyptothorax pulcher* sp. nov. (n = 27)**		
	Holotype	**Range**	**Mean ± SD**
Standard length (mm)	83.5	53.7–106.4	
% of SL			
Body depth	20.1	15.9–23.1	18.7 ± 1.7
Predorsal length	39.8	34.6–41.6	38.2 ± 1.7
Pre-anal length	70.0	67.1–73.4	70.3 ± 1.4
Prepelvic length	53.6	51.8–60.0	54.2 ± 1.7
Prepectoral length	20.8	19.2–26.6	21.5 ± 1.7
Length of dorsal-fin base	13.6	11.1–13.9	12.8 ± 0.7
Dorsal-fin spine length	12.8	9.5–14.3	12.1 ± 1.3
Length of anal-fin base	12.7	11.7–15.0	13.3 ± 0.8
Pelvic-fin length	16.9	13.5–16.9	15.5 ± 0.8
Pectoral-fin length	22.1	18.5–23.3	21.3 ± 1.3
Pectoral-fin spine length	11.6	10.4–14.8	12.9 ± 1.3
Caudal-fin length	26.0	20.9–26.6	24.2 ± 1.4
Length of adipose-fin base	12.8	11.7–15.4	13.8 ± 0.8
Dorsal to adipose distance	23.2	20.3–25.8	23.1 ± 1.5
Post-adipose distance	14.0	11.4–15.9	13.2 ± 1.0
Length of caudal peduncle	17.3	13.7–17.5	16.0 ± 1.0
Depth of caudal peduncle	11.8	10.3–12.3	11.4 ± 0.5
Body depth at anus	19.0	14.5–19.2	17.2 ± 1.3
Head length	29.6	25.7–29.7	27.6 ± 1.1
Head width	24.2	21.3–25.4	23.3 ± 0.9
Head depth	16.0	15.0–19.1	16.6 ± 1.0
Head depth at eye	11.4	10.9–13.2	11.9 ± 0.6
Length of thoracic adhesive apparatus	15.0	12.5–15.8	14.3 ± 0.7
Width of thoracic adhesive apparatus	14.0	12.0–14.3	13.2 ± 0.7
% of HL			
Snout length	47.1	46.2–52.3	48.1 ± 1.5
Interorbital distance	26.3	24.9–33.6	29.7 ± 2.1
Eye diameter	10.4	7.4–11.1	9.4 ± 1.1
Nasal barbel length	18.3	10.8–19.5	16.3 ± 2.1
Maxillary barbel length	76.9	52.5–76.9	66.9 ± 5.7
Inner mandibular barbel length	23.3	16.3–26.1	21.8 ± 2.3
Outer mandibular barbel length	43.6	31.2–43.6	37.0 ± 2.7

Figure 1. Lateral (**A**), ventral (**B**) and dorsal (**C**) views of *Glyptothorax pulcher* sp. nov., holotype, KIZ2025000024, 83.5 mm SL.

Barbels in four pairs. Maxillary barbel long, extending to pectoral-fin base. Nasal barbel slender, not reaching anterior orbital margin. Mandibular barbels two pairs and short. Inner mandibular barbel not or just reaching isthmus. Outer mandibular barbel extending to 2/3 distance between its base and that of pectoral spine.

Mouth inferior, premaxillary tooth band partially exposed when mouth closed. Oral teeth small and villiform, in irregular rows on all tooth-bearing surfaces. Premaxillary teeth in single crescent-shaped band, separated by narrow gap at mid-line.

Thoracic adhesive apparatus (TAA) consisting of skin ridges (striae) in a cordate field, with anterolateral striae, but anteromedial absent, extending from isthmus to posterior limit of pectoral-fin base. TAA broad, with length of 1–1.2 times its width and 1.08 times on average.

Anterolateral edges of TAA gently convex and posteromedial of it with a triangular medial pit, extending forward for at least half the length of TAA.

Dorsal fin inserted at mid-point of snout-tip and adipose-fin base origin, with I,6 rays; fin margin truncate; spine short and straight, smooth on anterior margin, posterior margin rough, without serration. Adipose fin base almost as long as anal-fin base, anterior margin straight, posterior margin roundish. Caudal fin strongly forked, lobes almost equal in some individuals and lower lobe slightly longer than upper in others, with i,7,8,i* (23) or with i,7,7,i (4) principal rays. Procurrent rays symmetrical and extending only slightly anterior to fin base, with about 9–11 short rays. Anal-fin base vertically opposite adipose-fin base. Anal fin with straight anterior and straight posterior margins; with iv,8* (18) or iv,7 (9) rays. Pelvic-fin origin at vertical posterior to posterior extremity of dorsal-fin base. Pelvic fin with slightly convex margin and i,5 (27) rays; tip of adpressed fin not reaching anal-fin origin. Pectoral fin with I,9* (19) or I,8 (8) rays; posterior fin margin straight; anterior spine margin smooth, posterior margin with 7–10 serrations, with the last two serrations hook-shaped.

Colouration. In 75% ethanol: brownish-black on dorsal and lateral surfaces of head and body, anterior 2/3 of caudal peduncle slightly lighter in some individuals. Light yellow on ventral region and TAA. Posterior orbital margin yellowish. Post-temporal with a small yellow ovate spot. Dorsal fin origin with three yellow spots or combined as a yellow saddle patch. Conspicuous or inconspicuous mid-dorsal stripe in yellow, extending to adipose fin origin forming a longitudinal spot. Another longitudinal spot in yellow located in posterior of adipose fin base.

All fins basically black and with a yellow margin. Dorsal fin black with its posterior margin yellow, the yellow portion extending forwards and upwards in a C-shaped band at the end of the dorsal fin base. Pectoral, pelvic and anal fins black, with irregular pincer-like yellow margin. Anterior half of anal fin black and in a shape of triangle, posterior half yellow, with a half-length black stripe in lower middle. Anal-fin base with a large triangular black blotch in ventral view. Caudal-fin base with a huge black dumbbell-shaped patch. Posterior margin of caudal fin yellow and M-shaped, similar black and yellow bands sequentially located medially.

When alive, brownish-black parts in 70% ethanol show a light chestnut colour and TAA show pale pink (Fig. 2).

Etymology. The epithet name "*pulcher*" consists of the Latin "pulcher", meaning beautiful, referring to the species' attractive colour pattern. Suggested common name in Chinese is 美丽纹胸鮡 (Chinese Pinyin: mei li wen xiong zhao).

Distribution and ecology. The new species is currently only known from Tuoniang River Basin (upper reach of the You River) in Yunnan and Guangxi, a sub-basin in the upper Pearl River system (Fig. 3).

Molecular phylogeny

Both phylogenetic methods (ML and BI) recovered a similar tree in topology (Fig. 4), based on two mitochondrial gene fragments (Cyt *b*, *CO*I) and also consistent with the results reported by Jiang et al. (2011). Species with dark brown to dark yellow body and black saddle-like patches beneath the dorsal and adipose fin formed a distinct monophyletic clade (in green), represented by *Glyptothorax hainanensis*, *G. honghensis* and *G. sinensis*. Species with a dark body

Figure 2. Living view of *Glyptothorax pulcher* sp. nov., holotype. KIZ2025000024, 83.5 mm SL.

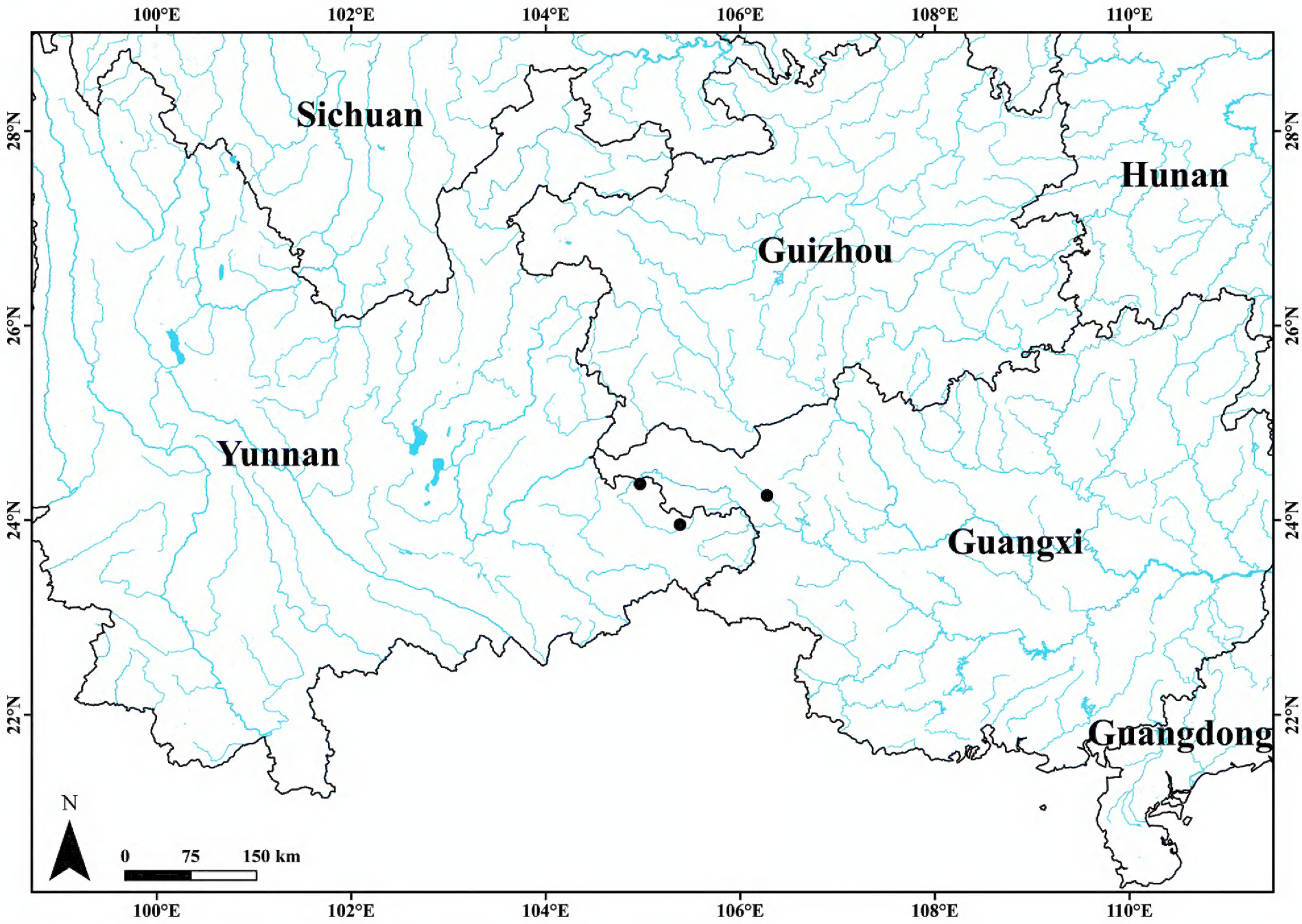

Figure 3. Map showing collection localities of *Glyptothorax pulcher* sp. nov.

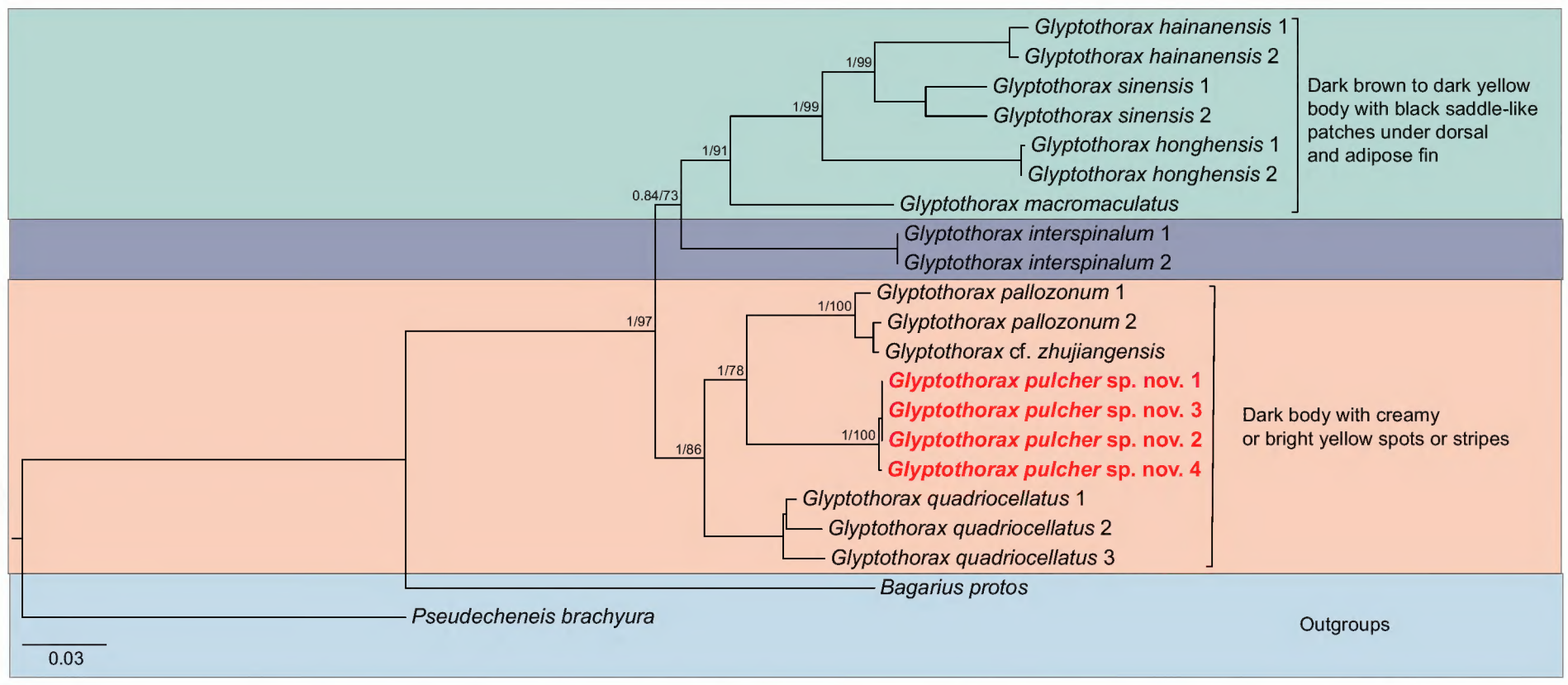

Figure 4. Bayesian Inference tree and Maximum Likelihood tree of nine *Glyptothorax* species inferred from *CO*I and Cyt *b* concatenated gene sequences. Bayesian posterior probabilities (right) and Maximum Likelihood bootstrap values (left) are shown.

and creamy or bright yellow spots or stripes formed another distinct monophyletic clade (in orange), represented by *Glyptothorax pulcher* sp. nov., *G. quadriocellatus* and *G. pallozonum*. The monophyly of the new species is strongly supported. Phylogenetic evidence indicated that *G. pulcher* is closely related to *G. pallozonum*, both of which are from the Pearl River, the estimated K2P genetic distances between the two range from 5.7% to 6.0% (Table 3).

Table 3. K2P distances (%) amongst four species of *Glyptothorax* with dark body and creamy or bright yellow spots or stripes, based on the *CO*I gene.

	1	2	3	4
1. *G. pulcher*				
2. *G. quadriocellatus*	4.7–5.7%			
3. *G. pallozonum*	5.7–6.0%	5.2–6.3%		
4. *G. zhujiangensis*	5.9–6.0%	5.1–6.2%	0.3%–1%	

Discussion

Only seven species of *Glyptothorax* were known from Pearl River and adjacent river systems, including the region from the Red River to China's south-eastern coastal areas, representing two distinct clades within the phylogeny of *Glyptothorax*, with the exception of one particular species, *G. interspinalum* (Jiang et al. 2011). *Glyptothorax pulcher* sp. nov. is most similar to *G. quadriocellatus* in morphology. It can be distinguished from all congeners, except *G. quadriocellatus*, in having a distinctive dark body with black and bright yellow spots and bands (vs. dark brown to dark yellow body with black saddle-like patches under dorsal and adipose fins in *G. hainanensis*, *G. honghensis* and *G. sinensis*, dark-coloured body with pale mid-dorsal stripe and lateral line band in *G. pallozonum*, dark-coloured body with pale mid-dorsal and lateral line stripe in *G. interspinalum*) (Fig. 5). It can be further distinguished from *G. hainanensis*, *G. honghensis*, *G. sinensis* and *G. interspinalum* in having smooth skin on head and sparse tubercules on sides of body, tubercules soft and similar in texture to skin (vs. tough and dense tubercules on head and sides of body, tubercules much harder than skin). The new species can be further distinguished from *G. interspinalum* in having broader TAA (length of 1–1.2 times its width, width of TAA 12.0–14.3% SL vs. length of 1.4–1.7 times its width, width of TAA 8.7.0–10.3% SL) and a shorter, deeper caudal peduncle (13.7–17.5% SL vs. 18.0–21.1% SL in length, 10.3–12.3% SL vs. 7.2–7.8% SL in depth). *Glyptothorax pulcher* can be distinguished from *G. quadriocellatus* in lacking a yellow spot behind eye (vs. present), smooth skin on dorsal surface of head (vs. with small tubercles on dorsal surface of head) (Fig. 6A, B), broader TAA (length of 1–1.2 times its width, width of TAA 12.0–14.3% SL vs. length of 1.2–1.5 times its width, width of TAA 9.4–11.1% SL), anteromedial striae absent on TAA (vs. TAA with significant anteromedial striae) (Fig. 6C, D) and shorter adipose-fin base (11.7–15.4% SL vs. 15.1–18.1% SL).

Glyptothorax zhujiangensis Lin, a species of taxonomic ambiguity, remains recognised as a valid taxon to date, but has not been reported since it was first described. Regrettably, the holotype and nine paratypes preserved at the Institute of Hydrobiology, Chinese Academy of Sciences, have been lost and repeated searches have yielded no results. The remaining ten paratypes were reportedly preserved at the Zhuhai Fisheries Research Institute in Guangdong Province, but no such institution has ever existed. Furthermore, no photographs of these specimens have been preserved. Based on the original description, this species exhibits a high degree of morphological resemblance to *G. pallozonum*, both of which are distributed within the Pearl River drainage of Guangdong Province. However, the type locality of *G. zhujiangensis* is located in Xinhui District, Jiangmen City, to the west of the Pearl River Estuary, while the type locality of *G. pallozonum* is located in Boluo County, Huizhou City, to the east of the Pearl River Estuary. The geographical distance between these two localities is less than 200 km and *G. pallozonum* has a relatively wider distribution range, from Yangjiang (Moyangjiang River) to Huizhou (Dongjiang River), including Xinhui District, Jiangmen City. According to Lin (2003), the morphological characteristics of *G. zhujiangensis* are generally consistent with *G. pallozonum*, but differ significantly from *G. quadriocellatus*. However, Lin did not compare *G. pallozonum* and *G. zhujiangensis* in detail.

Comparing Lin's original description of *G. zhujiangensis* (2003) with Chu & Mo's description of *G. pallozonum* (1999), the following differences can be speculated: depth

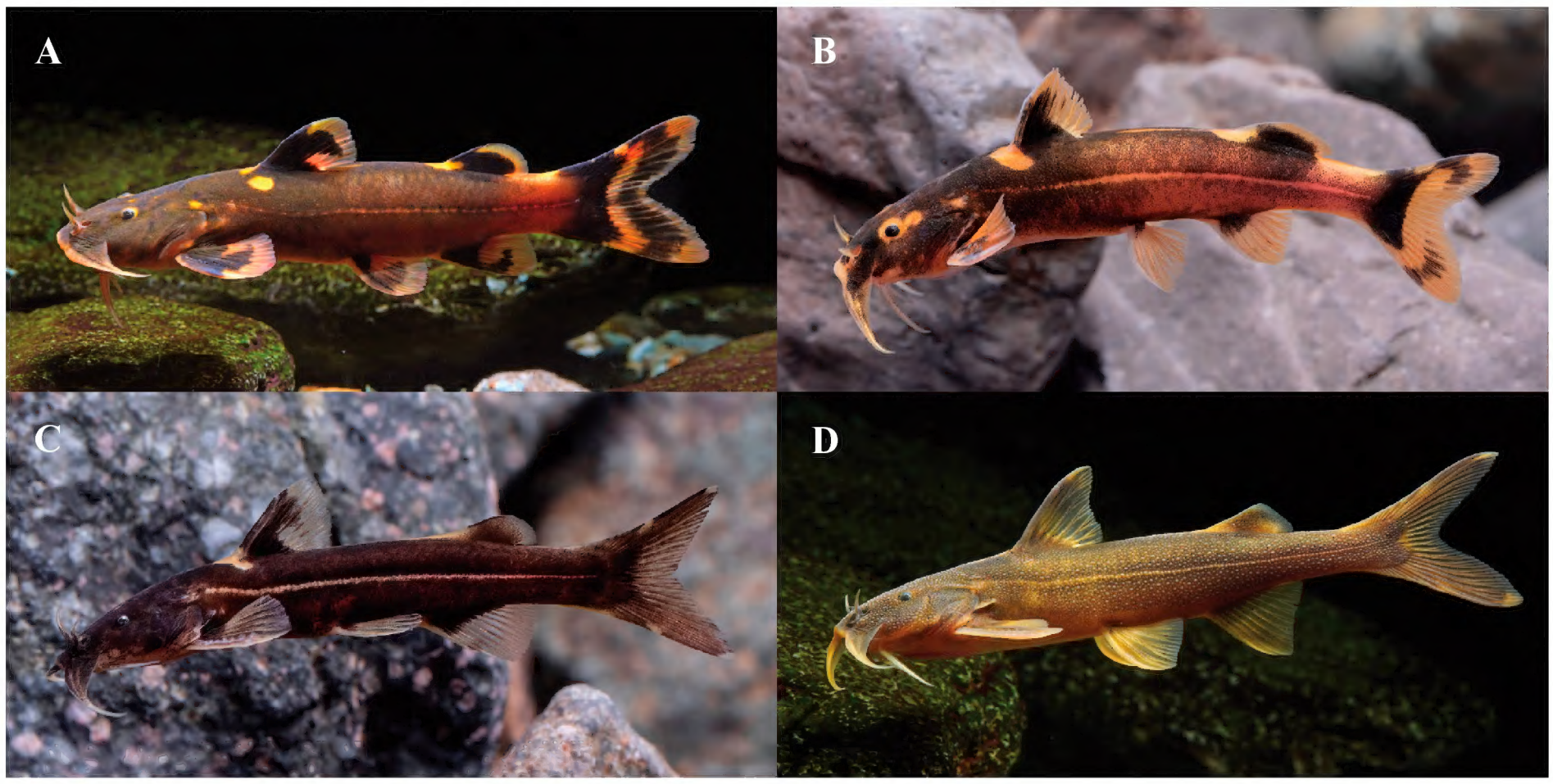

Figure 5. Living views showing different colour patterns of *Glyptothorax pulcher* and its most related congners: **A.** *G. pulcher*; **B.** *G. quadriocellatus*; **C.** *G. pallozonum*; **D.** *G. interspinalum*.

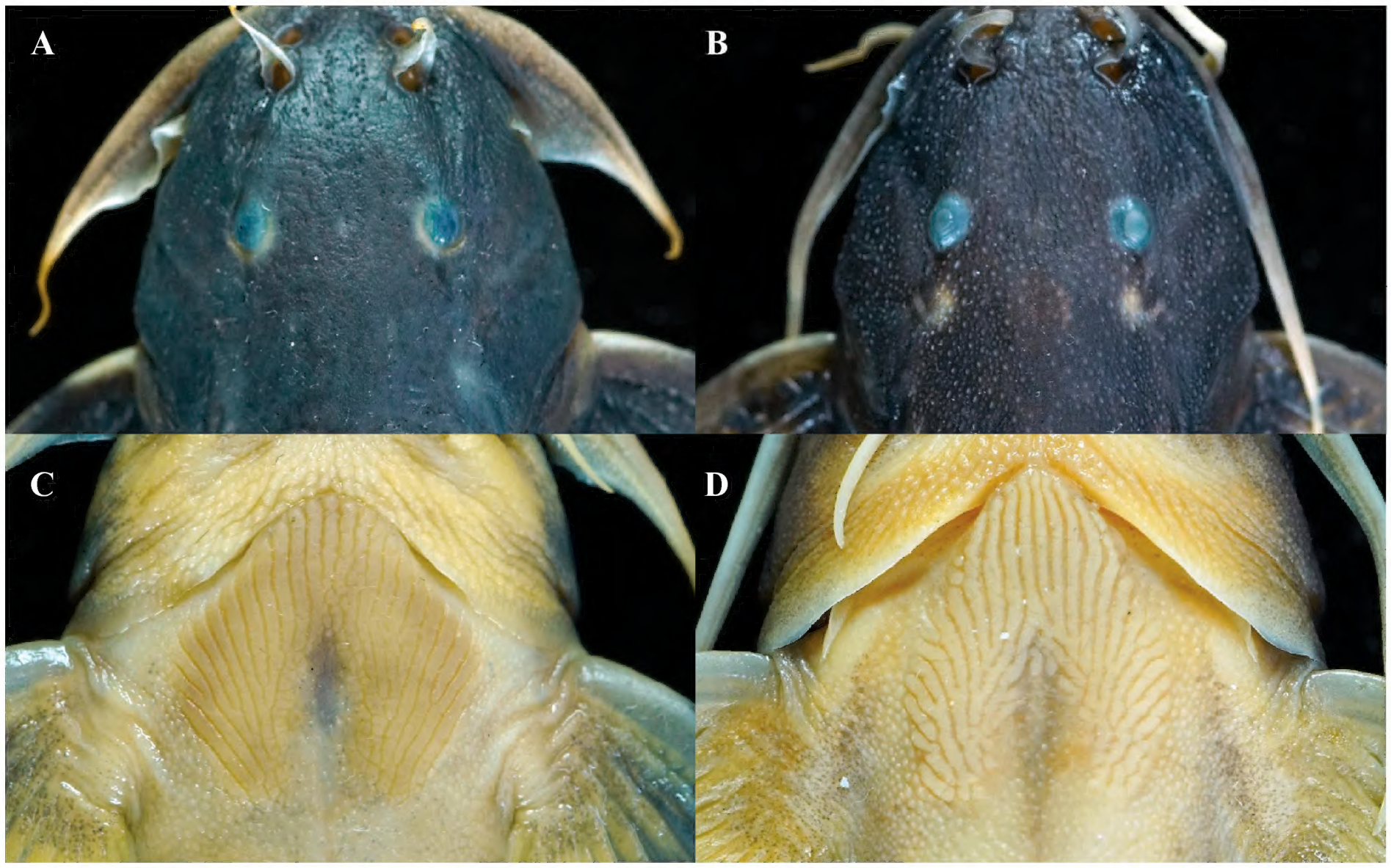

Figure 6. Dorsal views of heads and ventral views of TAA of *Glyptothorax pulcher* and *G. quadriocellatus*: **A, C.** *G. pulcher*, KIZ2025000024, 83.5 mm SL; **B, D.** *G. quadriocellatus*, KIZ2025000149, 80.0 mm SL.

of caudal peduncle (9.5–11.1% SL for *G. zhujiangensis* vs. 10.8–12.6% for *G. pallozonum*), snout length (38.5–45.5% SL for *G. zhujiangensis* vs. 45.5–55.5% SL for *G. pallozonum*), nasal barbel (not reaching anterior orbital margin for *G. zhujiangensis* vs. reaching anterior orbital margin for *G. pallozonum*), outer mandibular barbel (not reaching pectoral-fin base for *G. zhujiangensis* vs. reaching pectoral-fin base for *G. pallozonum*), dorsal-fin spine (posterior margin rough and tubercule-like for *G. zhujiangensis* vs. smooth for *G. pallozonum*), pectoral-fin spine (posterior margin with five serrations and few individuals with six for *G. zhujiangensis* vs. posterior margin with 6–8 serrations for *G. pallozonum*), caudal-fin length (greater than head length for *G. zhujiangensis* vs. less than head length for *G. pallozonum*). Chu and Mo (1999) did not provide a detailed description of the TAA of *G. pallozonum*, our examination revealing that it does not differ from Lin's (2003) description of the TAA of *G. zhujiangensis* i.e. triangular medial pit posteromedial, extending forwards for one-third length of TAA in *G. pallozonum* and the TAA with a slightly posteromedial pit in *G. zhujiangensis*. Lin's descriptions render the interpretation of the states to be too subjective. Apart from the evident disparity in snout length, the other characteristics appear to be inadequate for differentiating the two as distinct species.

We collected specimens of *Glyptothorax pallozonum* from the eastern side of the Pearl River Estuary and the Pearl River Delta, as well as specimens of *G.* cf *zhujiangensis*, collected from the Pearl River Delta, approximately 50 km away from the type locality of *G. zhujiangensis*. These two specimens of *G.* cf. *zhujiangensis* agree with the description of *G. zhujiangensis* in terms of the depth of caudal peduncle (11.1% SL vs. 9.5–11.1% SL for *G. zhujiangensis*), snout length (45.5% SL vs. 38.5–45.5% SL for *G. zhujiangensis*), dorsal-fin spine (posterior margin rough and tubercule-like), caudal-fin length (greater than head length) and shape of TAA (just with a slightly posteromedial pit), but differ in having longer nasal and outer mandibular barbels (nasal barbel just reaching anterior orbital margin, outer mandibular barbel just reaching pectoral-fin base vs. nasal barbel not reaching anterior orbital margin, outer mandibular barbel not reaching pectoral-fin base for *G. zhujiangensis*) and a pectoral-fin spine with seven serrations on their posterior margins (vs. 5–6 serrations for *G. zhujiangensis*). In our tree (Fig. 4), the species from the lower Pearl River (*G. pallozonum* 1, *Glyptothorax pallozonum* 2 and *G.* cf. *zhujiangensis*) formed a monophyletic clade. The estimated K2P genetic distances between *G. pallozonum* 1 and *G.* cf. *zhujiangensis* is 1.0% and between *G. pallozonum* 2 and *G.* cf. *zhujiangensis* is 0.3%, based on the mitochondrial *CO*I gene (Table 3).

Based on morphological comparisons, genetic evidence and distribution ranges, we postulate that *G. pallozonum* and *G. zhujiangensis* may be conspecific and the differences between them may likely due to populational differences. Differences in researchers' measurement methods and tools, observational errors and variations in specimen preservation conditions may all affect the accuracy of the data. Additionally, we note that the type specimens of *G. zhujiangensis* had standard length range of only 30.5–61.5 mm vs. 51.0–79.0 mm in *G. pallozonum* (Chu and Mo 1999).

Smaller specimens may amplify measurement and observational errors. Differences in living environments may also cause some geographic populations to develop differentiated traits, resulting in subtle differences, such as the length of barbels and fins, but these are of no taxonomic significance (Zeng et al. 2025). Overall, *G. zhujiangensis* should be regard as a junior synonym of *G. pallozonum*.

Comparative materials examined

1. *Glyptothorax hainanensis*: KIZ2012003763–82, 37.3–62.5 mm SL, China: Hainan Province: Baisha Li Autonomous County: Nandujiang River; KIZ2012005007–14, 33.4–69.7 mm SL, China: Hainan Province: Baisha Li Autonomous County: Nandujiang River.
2. *Glyptothorax honghensis*: KIZ2025000154–157, 60.2–90.3 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Hekou Yao Autonomous County, Nanxi River; KIZ2007002691–700, 21.7–66.2 mm SL, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Hekou Yao Autonomous County, Bazi River; KIZ2025000158, 64.0 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Gejiu City: Manhao Town, Red River.
3. *Glyptothorax interspinalum*: KIZ2008001353–57, 45.0–83.0 mm SL, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Lvchun County, Lixian River; KIZ2024000449, 89.5 mm SL, China: Yunnan Province: Puer City: Jiangcheng Hani and Yi Autonomous County: Qushui Town, Tuka River; KIZ2013000058–59, 71.0–73.1 mm, China: Yunnan Province: Chuxiong Yi Autonomous Prefecture: Chuxiong City: Shuangbai County: Dutian Township, Shiyang River; KIZ2025000162–163, 60.7–80.9 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Hekou Yao Autonomous County, Nanxi River; KIZ2025000159–161, 45.7–55.8 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Gejiu City: Manhao Town, Red River.
4. *Glyptothorax pallozonum*: KIZ2025000068–71, 45.5–53.3 mm SL, China: Guangdong Province: Shanwei City: Haifeng County; KIZ2010000741, 50.4 mm SL, China: Guangdong Province: Shanwei City: Haifeng County, Xiaoye River; KIZ000137–138, 39.2–40.0 mm SL, China: Guangdong Province: Foshan City: Gaoming District.
5. *Glyptothorax quadriocellatus*: KIZ2004007912–16, 40.0–71.6 mm SL, China: Yunnan Province: Puer City: Mojiang Hani Autonomous County, Sinan River; KIZ2025000146–147, 98.9–105.9 mm SL, China: Yunnan Province: Puer City: Jiangcheng Hani and Yi Autonomous County, Lixian River; KIZ2024000451–53, KIZ2024001577–89, 44.2–102.1 mm SL, China: Yunnan Province: Puer City: Ninger Hani and Yi Autonomous County, Babian River; KIZ2025000164, 75.3 mm SL, China: Yunnan Province: Puer City: Mojiang Hani Autonomous County, Amo River; KIZ2025000149, 80.0 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Lvchun County, Xiaohei River; KIZ2025000148, 64.8 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Lvchun County, Zhama River; KIZ2009002079–81; 44.9–76.6 mm, China: Yunnan Province: Honghe Hani and Yi Autonomous Prefecture: Lvchun County, Niukong Township, Niukong River; KIZ2024000450, 125.2 mm SL, China: Yunnan Province: Puer City: Zhenyuan Autonomous County, Gucheng Town, Enle River.
6. *Glyptothorax sinensis*: KIZ2016000584–85, 68.6–91.0 mm SL, China: Yunnan Province: Dali Bai Autonomous Prefecture: Heqing County, Jinsha River; KIZ2005001958–64, 61.8–91.9 mm SL, China: Guizhou Province: Qiannan Buyi and Miao Autonomous Prefecture; Libo County, Zhangjiang River; KIZ1979001973–75, KIZ1979002119–20; 69.7–85.1 mm SL, China: Sichuan Province: Leshan City; Minjiang River; KIZ2011001418–21, 59.2–75.8 mm SL, China: Guangxi Zhuang Autonomous Region: Guilin City; Yangshuo County, Guijiang River; KIZ1982000003, 81.1 mm SL, China: Hubei Province: Yichang City; Xingshan County, Xiangxi River; KIZ1997000011–12, 65.8–68.9 mm SL, China: Yunnan Province: Wenshan City: Guangnan County, Xiyangjiang River; KIZ1975000247, KIZ1975000249, 58.6–61.6 mm SL, China: Hunan Province: Yuanjiang River; KIZ2016002053–55, 72.4–85.7 mm SL, China: Sichuan Province: Panzhihua City: Yanbian County, Yalongjiang River.
7. *Glyptothorax* cf. *zhujiangensis*: KIZ2024010651–652, 46.2–51.3 mm SL, China: Guangdong Province: Zhongshan City: Wugui Mountain.

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Authors' contributions

Yu-Yang Zeng and Feng Lin conducted specimen collection, identification and examination, specimen measurements, extracted DNA, photography and cartography, molecular genetic analysis and manuscript preparation.

Hong-Fu Yang conducted specimen collection. Xin-Rui Pu handled calculation of morphological data and provided part of specimens. Xiao-Yong Chen and Wang-Sheng Jiang designed the study, provided guidance on this research, review and revision of the manuscript. All authors read and approved the final version of the manuscript.

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